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July 24, 2002

EX PARTE – Via Electronic Filing

Ms. Marlene Dortch
Secretary
Federal Communications Commission
The Portals
445 12th Street, S.W.
Washington, DC 20554

Re: CC Dockets No. 01-338, 96-98, and 98-147

Dear Ms. Dortch:

On July 24, 2002, Thomas Koutsky and George Ford (both of Z-Tel Communications, Inc.) met with Christopher Libertelli, Legal Counsel to the Chief of the Wireline Competition Bureau. Messrs. Koutsky and Ford also met with Robert Tanner, Ben Childers, Jonathan Reel, and Tom Navin, all from the Wireline Competition Bureau.

At these meetings, Messrs. Koutsky and Ford discussed issues raised in the comments and reply comments filed in the above-referenced dockets. Their oral presentation is summarized in the attached set of slides entitled "The 'Output Restriction' Impairment Standard" (Attachment I), which was also provided to the attendees. In addition, Messrs. Koutsky and Ford provided the attendees the attached excerpts from the following articles: Robert B. Ekelund, Jr. and George S. Ford, "Preliminary Evidence on the Demand for Unbundled Elements" (Attachment II); Robert B. Ekelund, Jr. and George S. Ford, "Innovation, Investment, and Unbundling: An Empirical Update" (Attachment III); and George S. Ford, and Michael D. Pelcovits, "Unbundling and Facilities-Based Entry by CLECs: Two Empirical Tests" (Attachment IV).

Messrs. Koutsky and Ford also provided and discussed excerpts from the following documents already included in these dockets as attachments to Z-Tel's comments and reply comments: Z-Tel Public Policy Paper No. 3, "An Empirical Exploration of the Unbundled Local Switching Restriction" (Attachment 8 to Z-Tel Comments); Z-Tel Policy Paper No. 4, "Does Unbundling *Really* Discourage Facilities-Based Entry?" (Attachment 9 to Z-Tel Comments); T. Randolph Beard, George S. Ford, and Thomas M. Koutsky, "Facilities-Based Entry in Local

Telecommunications: An Empirical Investigation" (Attachment 10 to Z-Tel Comments); and T. Randoph Beard and George S. Ford, "Make or Buy? Unbundled Elements as Substitutes for Competitive Facilities in the Local Exchange Network" (Attachment 3 to Z-Tel Reply Comments).

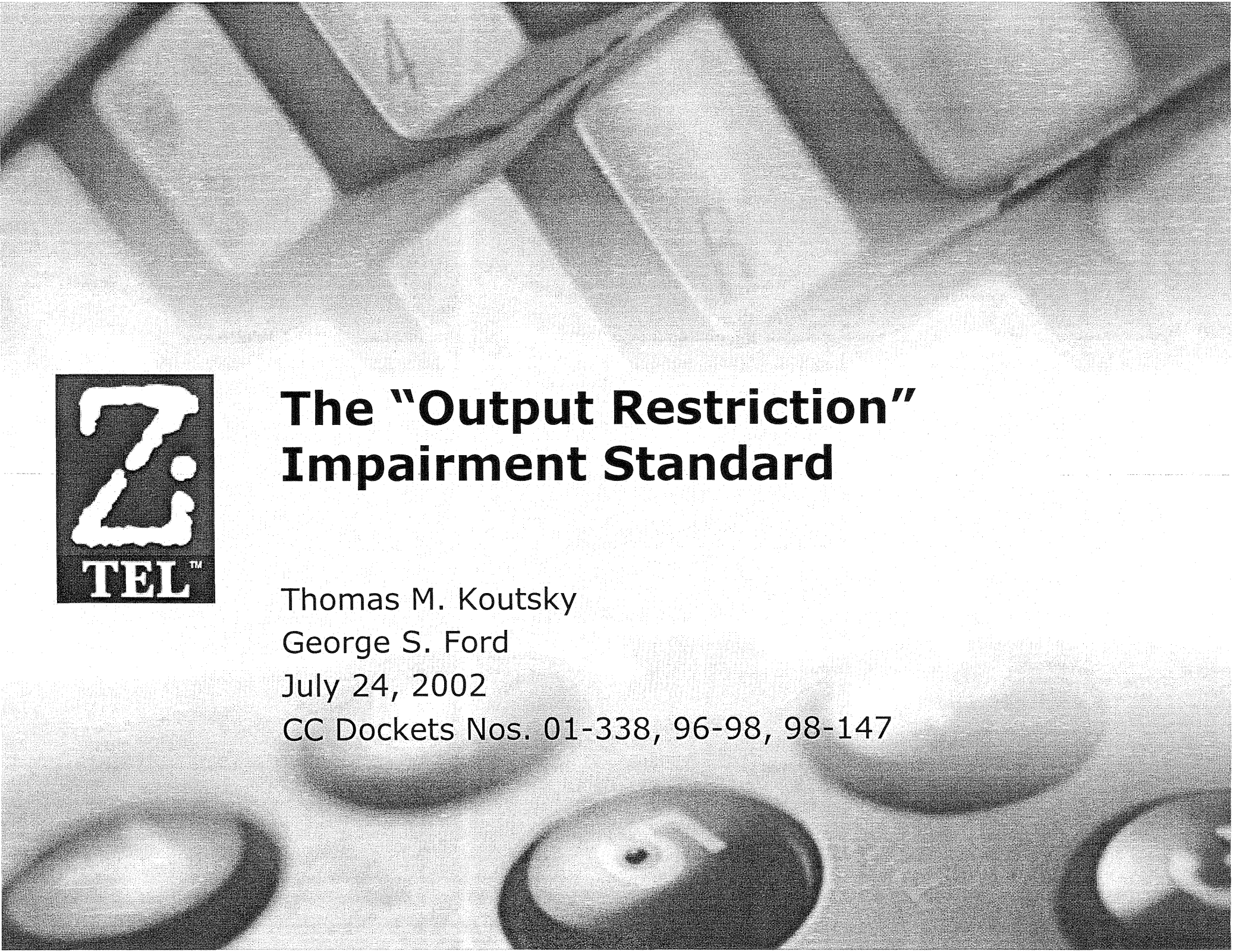
In accordance with FCC rules, a copy of this letter is being filed in each of the above-captioned dockets.

Sincerely,

Timothy J. Simeone
Counsel to Z-Tel Communications, Inc.

cc: Christopher Libertelli
Robert Tanner
Ben Childers
Jonathan Reel
Tom Navin

ATTACHMENT I



The "Output Restriction" Impairment Standard

Thomas M. Koutsky
George S. Ford

July 24, 2002

CC Dockets Nos. 01-338, 96-98, 98-147

Focus on the Consumer

- 1996 Act was about consumer choice in telecom services
- In the end, if we do *not* see increased consumer choice = the 1996 Act will have failed
- Six years after the Act, mass market consumers are finally seeing that choice in new, innovative telecom services and packages – because of UNE Platform

Today's Agenda

- The "Output Restriction" Impairment Standard

- Z-Tel Empirical Research on Unbundling, UNE pricing, and Facilities Deployment

Preliminary Points and Future Meetings

- Under any standard, Z-Tel's ability to serve mass-market customers would be impaired without access to UNE Platform
- Unbundled local loops, switching and transport required by section 271 checklist and Congressional intent
- UNE Platform and UNE Loop methods of entry are not substitutes – economically and operationally
- ILECs have *not* presented "granular" evidence sufficient to satisfy *USTA* – and Z-Tel has.
- Query: Can FCC satisfy *USTA* without FCC hearings, evidence and cross-examination, which was done in TX and now GA?
- Enlisting help of state commissions

The Output Restriction Test

Ford Reply Decl. Section III

Impairment exists when a lack of access to an ILEC network element reduces a CLEC's output by a significant and non-transitory amount

Why this test makes sense…

- It comes from the language of the Act
- Focuses upon output –
  - Output is what matters economically ("services" that CLEC "seeks to provide")
  - If not requiring unbundling increases sunk costs of entry – there will be less entry
  - Focuses upon *end impact on* CLEC of prices, "profitability," operational difficulties of self-provisioning
- "Significant" and "non-transitory" are "limiting principles" that are objective and grounded in antitrust law

Benefits of Output Restriction Test

- Carrier-Focused – addresses "the reality faced by hundreds of smaller entrants" (*Verizon* slip op. at 37)
- Market-Focused – not unbundling of "unvarying scope"
- Consumer-Focused – do consumers have access to as much choice as they would without unbundling?
- Objective and legally-sustainable framework: grounded in Entry Barriers analysis of DOJ/FTC Merger Guidelines
- No attention to "transitory" (<2 yr.) impediments on output
- Takes into account the **differences that matter**
  - Accounts for all forms of barriers recognized by antitrust scholars: blocked access, scale economies, capital requirements, and product differentiation
  - Accounts for differences in cost structure that cannot be overcome through other means
  - Analyzes differences in scale, scope or density economies that are related to entrenched position of ILECs
  - Assesses operational failings of alternatives (e.g., hot-cut issue for UNE-P)

Applying the Test

- Begin with market definition – the "service" requesting carrier "seeks to provide"
  - E.g.: the local telecommunications mass-market (Z-Tel Comments Attachment A, or >139MM lines)
- What are the demand-side requirements of "serving" that "market"?
  - Mass Market: low rev/mth, high churn (e.g., 5%/mth), customers geographically dispersed (not concentrated beyond normal population densities), no long-term contracts, responsive to mass market advertising
- What are supply-side requirements of "serving" that "market"?
  - Mass Market: ubiquitous coverage (necessary for mass marketing campaign to work), automated provisioning, low cost of customer acquisition, ability to handle huge volumes for churn and growth
- **Without unbundled access, can entrant serve as many customers within 2 years as with unbundled access, or will denial of unbundling result in significant and non-transitory restriction on output?**

Empirical Analysis of Unbundling

Ford Reply Decl. Section IV

- *USTA* court: "the record is silent" on impact of unbundling on facilities deployment

- SBC admits that empirical evidence in support of their position is slight, possibly nonexistent
  - SBC Comments at 7: until comments filed, ILECs had been unable to "marshal sufficient real-world experience and empirical evidence" to "back up" their claims that unbundling dis-incents facilities-based competition
  - "Evidence" attached by SBC thoroughly discredited in Ford Reply

- Z-Tel Comments and Replies:

  This Record is No Longer "Silent"

Z-Tel Empirical Research

- ***Residential/Small Business Competitive Entry greater where UNE Platform available without restriction***
  - Z-Tel Policy Paper No. 3
  - Data: FCC Local Competition Reports, has been updated with most-recent data

- ***UNE-P promotes facilities investment***
  - Z-Tel Policy Paper No. 4
  - Data: looks at switch deployment over time, using FCC Local Competition data, LERG
  - Why these results? Because…
    - UNE-P CLECs buy network facilities!
    - UNE-P lowers entry barriers to retail competition – which leads to wholesale network deployment
    - "Rising Tide Raises All Boats" – during transition from monopoly, *all* entrants benefit from more-competitive market for *all* services

More Research…

- ***Lower UNE prices do not "discourage" facilities-based entry***
  - Beard, Ford and Koutsky, *Facilities-Based Entry into Local Telecommunications* (2002) (attached to Z-Tel Comments)
    - Data: FCC Form 477 data, LERG, state UNE prices
    - Study also supports findings of Policy Paper No. 4
    - Unrebutted in BOC replies
  - Pelkovits and Ford, *Unbundling and Facilities-Based Entry by CLECs* (2002)
    - Data: ARMIS, FCC Form 477 data (latest available data)
- ***Unbundling and "facilities-based" entry are not substitutes***
  - Beard and Ford, *Make or Buy? Unbundled Elements as Substitutes for Competitive Facilities* (2002)
  - Data: FCC Form 477 data, state UNE prices
  - Estimated demand curves for unbundled loops purchased with switching (UNE-P) and without switching (UNE-L)
  - Comparing elasticity of these curved indicates whether CLECs view UNE-P and UNE-L as substitute forms of entry, or whether they are different forms of entry to serve different markets
  - Results: UNE-P and UNE-L are not substitutes

For More Information…

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ATTACHMENT II

Preliminary Evidence on the Demand for Unbundled Elements

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GEORGE S. FORD, V.P. Strategic Planning and Chief Economist, Z-Tel Communications, 601 S. Harbour Island Blvd., Tampa, Florida 33602.

The Telecommunications Act of 1996 requires incumbent local exchange carriers to lease elements of their networks to competitors to promote competition in monopoly markets. Prices for these elements are set by state regulatory commissions based on estimates of cost. The development of competition and, consequently, the success of the Act depends on UNE prices since demand for unbundled network elements (UNEs) slopes downward. This note provides the first empirical evidence on the demand for UNEs.

To date, the most successful form of competitive entry using elements is the UNE-Platform – a combination of unbundled loops and end-office switching, so our analysis focuses on that entry mode. A reasonable approximation of the ordinary demand for UNE-Platform is

$$\ln Q_i = \alpha_0 + \alpha_1 \ln P_i + \sum_{j=1}^{n} \alpha_j Z_i + \varepsilon_i \qquad (1)$$

where Q is the quantity demanded of loop-switching combinations in state i, P is the regulated price for loop-switching combinations in i, Z is a vector of other factors that affect demand in i, and ε is the disturbance.

Variables in Z include: (Z_1) total demand, measured as the local service revenue in the state; (Z_2) the percent of total, analog switched access lines serving residential customers; (Z_3) a dummy variable for New York and Texas, both leading states in the promotion of competition; (Z_4) a dummy variable if the incumbent is allowed to provide interLATA long distance (AR, KS, MA, MO, NY, OK, PA, TX,); (Z_5) a dummy variable if the installation charge to competitors for the element combination exceeds $50; and ($Z_6$) a dummy variable for the dependent variable's date (0 for June 2001, 1 for December 2001). The Federal Communications Commission provides data for Q, Z_1, and Z_2, and all price data is provided by Z-Tel Communications. A total of 67 observations are used.

The estimated regression is

$$\ln Q = 6.1 - 2.7 \cdot \ln P + 0.3 \cdot \ln Z_1 + 0.75 \cdot Z_2 + 2.7 \cdot Z_3 + 0.33 \cdot Z_4 - 1.0 \cdot Z_5 + 0.15 \cdot Z_6 + \varepsilon. \quad (2)$$

Results from the least squares estimation are excellent. The R^2 is 0.68, and Ramsey's RESET Test indicates correct specification. The variables P, Z_3 and Z_5 are statistically significant at the 5% level (t = -4.84, 4.43, -2.10), and Z_1 at the 10% level (t = 1.66). The (derived) demand for loop-switching combinations increases in total market demand, is higher in New York and Texas, and declines with high installation fees. Other variables show no effect.

The own-price elasticity of demand is in the elastic region of demand (-2.7), as is the entire 95% confidence interval (–1.6 to –3.84). The quantity demanded is highly sensitive to price, and state regulators that set higher prices are reducing substantially the level of competition provided over the UNE-Platform. This result suggests that competition is inhibited where the prices of elements are high. These estimates should assist state regulators in assessing the impact of element rates that are typically determined in complex and adversarial rate proceedings.

ATTACHMENT III

Innovation, Investment, and Unbundling: An Empirical Update

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GEORGE S. FORD, Chief Economist, Z-Tel Communications, Tampa, Florida, gford@z-tel.com.

I. Introduction

In Winter 2000 issue of this *Journal*, Thomas Jorde, Gregory Sidak, and David Teece (JST) commented on some potential economic consequences of the Telecommunications Act of 1996 as implemented by the Federal Communications Commission (FCC). The article, published early in the implementation phase of the Act, contained many general assertions about potential consequences, but contained no empirical evidence. JST did, however, offer some interesting and testable propositions. One of them suggests an important issue, for which implementation is rather straightforward: JST propose that mandatory unbundling increases the "riskiness and cyclicality of the ILEC's [Incumbent Local Exchange Carriers] economic performance and, hence, on the ILEC's weighted-average cost of capital. Mandatory unbundling raises both components of the weighted-average cost of capital for ILECs – equity and debt" (2000: 19). The purpose of this brief comment is to perform that empirical test and to compare our empirical results with the expectations of JST.

II. The Impact of Mandatory Unbundling: An Empirical Test

The goal of the Telecommunications Act of 1996 was to "promote competition" and "reduce regulation" (1996 Act, Preamble). As part of this effort, the Act required the ILECs to lease the elements of their networks – unbundled elements – to their rivals at prices commensurate with costs. JST conclude that mandatory unbundling will have adverse affects on the investment of both the incumbent phone companies as well as prospective entrants. One of the many alleged sources of these investment distortions was the effect of mandatory unbundling on the incumbent local exchange carriers' (ILECs) cost of capital. With regard to the cost of equity, the authors indicate "[t]he cost of equity capital depends on the systematic or "beta" risk of the firm. ... How does mandatory unbundling affect an ILEC's beta and thus its cost of equity? The answer depends on how unbundling affects the cyclicality of an ILEC's return" (2000:

19). JST assert that the mandatory unbundling increases the cyclicality of the ILECs' return, so beta should increase during an economic downturn. During periods of "weak demand" (i.e., recession), according to JST, the justification of facilities deployment is more difficult for CLECs. During these periods these firms are more likely to lease unbundled elements than to construct their own facilities. Weak demand for telecommunications services compounded with an increased demand for unbundled elements, both of which lower end-user prices and thus profits, and the potential the elements are priced below costs, all "intensif[y] the cyclicality of an ILEC's returns" (2000: 19).

Assessment of the impact of a recession (or any event for that matter) on a firm's beta coefficient is straightforward, and such analysis is frequently employed. A firm's beta is estimated by:

$$R_i = \alpha_i + \beta_i R_m + \varepsilon_i \tag{1}$$

where the R_i is the stock return on firm i , R_m is the return on a broad market index, α_i is the intercept, β_i is the beta for firm i, and ε_i is the econometric disturbance term. Equation (1) is estimated by ordinary least squares (OLS), and typically employs daily or monthly returns over periods of various time intervals.

In the present context, it is not the firm beta that is of primary interest, but the difference in beta between a period of economic expansion (β^E) and economic recession (β^R). A statistical test for the non-stationarity of beta across time periods involves a slight modification to Equation (1):

$$R_i = \alpha_i + \beta_i R_m + \gamma_i D + \Delta_i D \cdot R_m + \varepsilon_i \tag{2}$$

where D is a dummy variable that equals 1.00 during the period of economic recession (0 otherwise), γ_i measures the change in the intercept during the recession, and, most importantly, Δ_i measures the change in beta during the recession period (Daves, et al., 2000). From Equation (2), the expansion and recession betas can be computed, where $\beta^E = \beta_i$ and $\beta^R = \beta_i + \Delta_i$. The JST hypothesis is that $\Delta_i > 0$, so that the $\beta^R > \beta^E$. The statistical significance of the estimated coefficient Δ_i measures the statistical significance of the null hypothesis that $\beta^R = \beta^E$.

For obvious reasons, JST did not perform this statistical test of their hypothesis regarding the cost of equity capital in their article. As the authors observe, "there has not been a recession since the Telecommunications Act of 1996, [so] the conjecture about increased systematic risk is not falsifiable" (2000:

19). At the time of publication, the U.S. was in the midst of one of the longest economic expansions in history. According to the National Bureau of Economic Research, however, this economic expansion ended in March 2001 and has continued until the present (June 2002). Thus, this empirical test of the JST hypothesis can be performed.

Equation (2) is estimated using daily stock returns for the three Regional Bell Operating Companies (RBOCs) -- BellSouth (BLS), Verizon (VZ), and Southwestern Bell (SBC) – and an index of the three companies.[1] The market index is measured by the S&P 500. Betas are computed using data for three (224 observations) and five years (328 observations) preceding the recession (March 2001), producing a total of eight regressions.[2] Regression results and the estimated values of β^E and β^R are summarized in Table 1. To improve efficiency of the estimates, the regressions are estimated using generalized least squares.[3]

[1] This index was computed as a simple average of the stock prices of the three RBOCs.

[2] Data for the recession period spans March 2001 through June 17, 2001 (the latter being the last reported stock price for the date the data was collected). The three-year betas were computed at the start date March 1998, and the five-year betas were computed with a start data of March 1996. The recession period includes 67 observations. Historical data is provided at no charge by finance.yahoo.com.

[3] For all regressions, the null hypothesis of homoscedastic errors is rejected.

Table 1. Regression Results

RBOC	α_i	β_i	γ_i	Δ_i	R^2	β^E	β^R
BLS	0.003	0.320	-0.005	-0.052	0.05	0.32	0.27
(3 Year)	(0.85)	(2.65)*	(0.91)	(0.25)			
BLS	0.003	0.482	-0.005	-0.215	0.08	0.48	0.27
(5 Year)	(1.05)	(4.89)*	(0.97)	(1.11)			
VZ	0.002	0.547	-0.003	-0.143	0.11	0.55	0.40
(3 Year)	(0.46)	(4.57)*	(0.46)	(0.68)			
VZ	0.001	0.603	-0.003	-0.198	0.14	0.60	0.40
(5 Year)	(0.58)	(6.56)*	(0.51)	(1.10)			
SBC	0.002	0.695	-0.006	-0.418	0.11	0.70	0.28
(3 Year)	(0.57)	(4.98)*	(0.89)	(1.71)*			
SBC	0.002	0.719	-0.006	-0.442	0.14	0.72	0.28
(5 Year)	(0.61)	(6.89)*	(0.98)	(2.16)*			
Index	0.002	0.520	-0.005	-0.198	0.12	0.52	0.32
(3 Year)	(0.61)	(4.84)*	(-0.84)	(1.05)			
Index	0.002	0.598	-0.004	-0.276	0.15	0.60	0.32
(5 Year)	(0.75)	(7.20)*	(-0.93)	(1.70)*			

* Statistically significant at the 5% level or better.

All the estimated betas (β_i) for the RBOCs are less than 1.00 and statistically significant. None of the constant terms (α_i, γ_i) are statistically different from zero. The estimated coefficient Δ_i is of primary interest. For all three RBOCs and an index of the companies, the estimated coefficient Δ_i is *negative*. In no case is a positive value for Δ_i observed. For three of the eight regression models, the null hypothesis of an equal beta during economic expansion and recession is rejected. For SBC (3 and 5 year) and the index (5 year only), the recession beta is less than the expansion beta ($\beta^R < \beta^E$). In no case can the JST hypothesis that $\beta^R > \beta^E$ be accepted, and in three cases it is rejected at the 5% significance level. Consistently, it appears that the recession has reduced, if anything, the variability of the RBOC stocks and, consequently, reduced the cost of equity capital.

III. Conclusion

The Telecommunications Act of 1996 was passed to promote competition in one of the most advanced technological areas of the economy. A major debate

has raged concerning the impact of mandatory unbundling as a means of introducing competition in local exchange markets. One proposed hypothesis is that mandatory unbundling increases the riskiness and cyclicality of ILECs performance, creating an adverse impact on their cost of capital. In addition to the effects of a generalized weaker demand for ILEC services during downturns, these firms would be faced with an increased demand by CLECs for unbundled elements. Such factors would both intensify the cyclicality of ILECs returns and increase capital costs.

Using a standard model for risk measurement and data for RBOC that includes periods of both expansion and recession we find no evidence that recession increases the variability and risk of ILEC stocks. Indeed, there is some evidence that the opposite might be the case. This implies that, on these grounds, mandatory unbundling does not increase the financial vulnerability of ILEC firms and their cost of equity capital.

References

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Jorde, Thomas M., J. Gregory Sidak, and David J. Teece, Innovation, Investment, and Unbundling, *Yale Journal on Regulation*, Vol. 17, Winter 2000, pp. 1-37.

Telecommunications Act of 1996, Public Law No. 104-104, 202, 110 Stat. 56 (1996).

ATTACHMENT IV

Unbundling and Facilities-Based Entry by CLECs: Two Empirical Tests

George S. Ford, Ph.D., Chief Economist, Z-Tel Communications Inc., Tampa, FL, 33602, gford@z-tel.com.

Michael D. Pelcovits, Ph.D., Chief Economist, MCI-Worldcom Inc., Washington, DC, 20006, michael.pelcovits@wcom.com.

In this paper, the determinants of the provision of facilities-based lines by competitive local exchange carriers ("CLECs") are examined using data collected by the Federal Communications Commission and the entry decisions of a large, facilities-based CLEC. The multiple regression models are based on the economics of entry, considering both the effects of market size and sunk costs on provision of facilities-based service to end-users by CLECs.

Following Martin (1988), Sutton (1990) and Beard and Ford (2002), the extent of facilities-based entry by CLECs is assumed to be a positive related to market size and inversely related to the fixed/sunk costs of entry.[1] Size is measured as the total revenues of the Bell Operating Company ("BOC") in the state (*SIZE*) in millions of dollars. Sunk cost requirements are assumed to be inversely related to the density of market size, measured as BOC total revenues per square mile (*DENSE*). The percent of the state's population living in metropolitan areas, another measure of density, should also reduce the sunk costs of facilities investment (*METPOP*).[2]

The unbundling obligations and the companion pricing standard for unbundled elements may influence facilities-based entry in a variety of ways. So, the unbundled loop (highest density zone) and switching price in the state (*PLOOP*, *PSWITCH*) are included as regressors in the model.

Positive signs are expected on the market size and density variables (*SIZE*, *DENSE*, and *METPOP*). No a priori expectations are made with respect to the unbundled loop prices, since either a positive or negative sign is consistent with theory - element prices are ambiguously related to market size and the (exogenous and/or endogenous) sunk costs of entry.[3] Lower element prices, for example, may lead to more intense price competition and/or indicate a more favorable regulatory environment. Complementarity between elements and facilities may assist facilities-based entry by expanding market size or reducing entry costs. Additionally, unbundled element rates are estimates of average incremental cost at minimum viable scale. Thus, the element rates may serve as reasonable proxies for the average cost of duplicative network.[4]

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[1] The equilibrium number of firms in an industry, N^*, can be written as $N^* = (S/E)^{0.50}$, where S is market size and E is sunk entry costs. See, e.g., JOHN SUTTON, SUNK COST AND MARKET STRUCTURE (1990), Ch. 3; T. Randolph Beard and George S. Ford, *Competition in Local and Long-Distance Telecommunications Markets*, *in* INTERNATIONAL HANDBOOK OF TELECOMMUNICATIONS ECONOMICS, Volume I (Gary Madden ed. 2002); *and* STEPHEN MARTIN, INDUSTRIAL ECONOMICS: ECONOMIC ANALYSIS AND PUBLIC POLICY (1988), at 197-98.

[2] RCN, a facilities-based entrant, has limited its entry to the most densely populated markets (RCN 2001 10-K).

[3] Facilities-based entry is more common in dense markets, and loop prices are lower in dense markets (which is expected). The average loop price in the five largest CLEC facilities-based markets is about 30% less than the smaller markets (means difference t-stat = 2.72). If the density measures in the regression do not properly account for the total influence of density on entry, then the sign on the loop price may simply arise from this correlation, and not causation *per se*.

[4] Cost equivalence is not required, just correlation.

Finally, Beard and Ford (2002) and Ekelund and Ford (2002) show that that entry using unbundled elements is higher in markets where element prices are lower (i.e., element demands slope downward).[5] Thus, the relationship between entry via elements and facilities also is measured by the coefficients on the element prices.[6]

The estimated (semilog) regression equation is

$$\ln FBE_i = a_1 + \sum_{j=2}^{6} a_j X_i + \varepsilon_i ,$$

where all the X_i are measured at the state level i (BOC data only) and ε is a well-behaved, econometric disturbance term. Two vintages of the dependent variable data (Dec-2000 and June-2001) are used to estimate the equation.[7] Data limitations produce 62 usable observations.

The quantity of CLEC facilities based lines (*FBE*) is compiled by the FCC (Form 477 data). Market size (*SIZE*) is provided by ARMIS 43-04 (Year 2000). Square miles and metropolitan population are census data. The loop price (*PLOOP*) is the loop price for the highest density zone (Gregg 2001).[8] Switching element price (switching and transport) is based on individual element prices from interconnection agreements and state tariffs.

The results of the least squares regression are summarized in Table 1. The R-square of the regression is 0.83, so the model explains 83% of the variation in the dependent variable. All variables but *DENSE* are statistically significant at the 2% level or better in a two-tail test. *DENSE* is statistically significant at the 8% level in a one-tail test. Ramsey's RESET test does not indicate that specification error is a problem (22% significance level), but White's test rejects homoskedastic disturbances (4% significance level). Thus, White's standard errors are used to compute the t-statistics reported in the table.

All market size and sunk cost proxy variables (*SIZE*, *DENSE*, and *METPOP*) have the correct sign (positive), and only *DENSE* is not statistically significant at standard levels (for a two-tail test). While unbundled element prices may influence facilities-based entry in a variety of ways, the regression results indicate that unbundled element prices have negative and statistically significant relationships to facilities-based entry by CLECs. The estimated elasticities of primary interest include 0.48 for *SIZE*, -0.43 for *PLOOP*, and -0.55 for *PSWITCH*. A 10% increase in the loop rate, for example, reduces CLEC facilities-based entry by about 4%. The elasticities of demand for the elements themselves are elastic, averaging about -1.5.[9]

Table 1. Least Squares Results

Variable	Coef. (White t-stat)	Mean (St. Dev.)
Constant	9.84	
	(16.38)	
SIZE	0.27	2.39
	(11.45)	(2.10)
DENSE	0.003	21.27
	(1.45)	(25.87)
METPOP	2.35	0.75
	(3.85)	(0.15)
PLOOP	-0.032	12.55
	(-2.31)	(4.22)
PSWITCH	-0.035	13.73
	(-3.13)	(6.14)
FBE		154,018
		(173,971)
R^2	0.82	
White F	2.41	
RESET F	1.64	

In an alternative regression, the entry of RCN Communications in particular markets (states) is evaluated. RCN is the largest facili-

[5] T. R. Beard and G. S. Ford, *Make or Buy? Unbundled Elements as Substitutes for Competitive Facilities in the Local Exchange Network* (June 2002) and R. B. Ekelund Jr. and G. S. Ford, *Preliminary Evidence on the Demand for Unbundled Elements* (June 2002).

[6] Simultaneity bias precludes the estimation of one type of CLEC output (facilities-based, elements, resale) on another, without an estimation technique that properly accounts for the joint determination of the two series.

[7] Preliminary regressions indicated no statistically significant difference between the output levels of the two vintages.

[8] Billy Jack Gregg, *A Survey of Unbundled Network Element Prices in the United States* (2001).

[9] See Beard and Ford (2002) and Ekelund and Ford (2002).

ties-based provider of telephone, cable, and internet services to residential subscribers. The company provides service to more than one-million subscribers in six markets: New York, Massachusetts, Pennsylvania, Illinois, California, and the District of Columbia.[10] It is worth noting that about 12% of RCN's end-user service is provided over incumbent local exchange facilities.[11]

RCN's entry into a market is indicated by a dummy variable equal to 1.00 in the above listed markets, 0 otherwise (*DRCN*). The same explanatory variables are used with the exception of *PSWITCH*, which is excluded because the missing values for the variable reduce the already small number of RCN markets.

A total of 48 observations are used to estimate the probit equation, and results are summarized in Table 2. Reported t-statistics are based on robust standard errors. The McFadden R-square (likelihood ratio index) for the probit is 0.75

As before, size is found to positively influence entry, whereas sunk costs reduce entry. Both *SIZE* and *DENSE* are statistically significant at standard levels (*METPOP* is significant at the 10% level in a one-tail t-test). The probability RCN enters a particular market is negatively related to the unbundled loop price (*PLOOP*).[12] The *PLOOP* variable is statistically significant at better than the 5% level.

Table 2. Probit Results for RCN Entry

Variable	Coef. (t-stat)	Coef. (t-stat)	Mean (St. Dev.)
Constant	-6.03	-10.52	
	(1.15)	(1.80)	
SIZE	0.54	0.32	1.79
	(2.83)	(2.44)	(1.95)
DENSE	0.001		96.06
	(5.05)		(521.0)
METPOP	8.49	14.48	0.68
	(1.29)	(2.02)	(0.21)
PLOOP	-0.42	-0.39	13.47
	(-2.28)	(-3.06)	(4.87)
DRCN			0.125
			(0.33)
McFadden R^2	0.75	0.68	

The District of Columbia is a clear outlier for the *DENSE* variable, and a RCN market.[13] In an alternate specification, *DENSE* is excluded as a regressor. In this regression, METPOP is statistically significant at better than the 5% level. The coefficient on *SIZE* declines slightly, but the *PLOOP* coefficient is not materially altered.

These estimated regressions indicate that CLEC facilities-based entry is positively related to market size and inversely related to the sunk costs of entry. Both regressions indicate that unbundled element prices are inversely related to facilities-based entry. While the exact determinants of these inverse relationships cannot be determined (by these models), the results indicate that, on average and other things constant, higher element rates are associated with a reduced amount of facilities-based entry by CLECs.

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[10] RCN 2001 10-K.

[11] RCN 2001, 3 Qtr 10-Q.

[12] The average loop price in RCN markets is about 63% of the average loop rate in other markets (means-difference t = 2.57).

[13] The sizeable increase in the standard deviation of *DENSE* (relative to Table 1) is attributable to the inclusion of the District of Columbia.